Title: CHILD-RESISTANT UTILITY LIGHTER INCORPORATING A CAM MECHANISM AND A LEVER SPRING LOCK

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RELATED PATENT APPLICATIONS

This application is a continuation of Serial No. 09/794,989, filed February 26, 2001, now U.S. Patent No. 6,325,617 issued December 4, 2001, which is a continuation of the following applications:

Serial No. 09/751,628, filed December 30, 2000, which claims priority to Serial No. 09/531,082, filed March 18, 2000, now U.S. Patent No. 6,168,420 issued on January 2, 2001, which claims priority to Serial No. 09/507,100, filed February 17, 2000, now U.S. Patent No. 6,186,773 issued on February 13, 2001, which claims priority to Provisional Application Serial No. 60/126,326, filed March 26, 1999;

Serial No. 09/716,573, filed November 17, 2000, which claims priority to Serial No. 09/507,100, filed February 17, 2000, now U.S. Patent No. 6,186,773 issued on February 13, 2001; and

Serial No. 09/572,509, filed May 18, 2000, which claims priority to Serial No. 09/531,083, filed March 18, 2000.

BACKGROUND OF INVENTION

1. FIELD OF INVENTION:

This invention relates to a utility lighter which contains a safety feature incorporating a cam mechanism and a safety button, wherein normal operation of the lighter through depression of the trigger is impeded by the safety feature, and wherein operation of both the safety button and the trigger will produce a flame.

This invention also relates to a utility lighter which contains a safety feature incorporating a safety button or release lever, wherein the safety button slides forward to operate the fuel-release valve and unlock the trigger.

2. BACKGROUND ART:

Utility lighters are very useful and have become quite prevalent in modern times. Utility lighters of the type described herein generally contain a handle and an elongated lighting rod. The shape and operation of utility lighters allow for several advantages over normal means of producing a flame. Most significantly, due to the elongated nature of the lighting rod, utility lighters enable the operator to stand a safe distance away from the object to be ignited before actuating the lighter, thus avoiding a large number of potential accidents. In addition, utility lighters allow a flame to be produced in hard-to-reach or narrow places, where the human hand holding a match would not normally fit. Still, in the hands of children, or others who do not know how to safely and properly operate the lighter, such

lighters are as dangerous as any other spark and/or flame-producing device. Therefore, a need has been realized to equip utility lighters with safety features that minimize accidental or improper use by inexperienced persons, especially young children.

Many inventions have been created to address this safety-related concern. Generally, these inventions have sought to introduce safety mechanisms that disable automatic operation of either the spark-generation and/or the fuel-release function of the lighter. For example, some utility lighters provide for a blocking mechanism, where the actuating trigger is blocked from moving the required distance for a spark to be generated. In these lighters, the locking mechanism is normally de-activated by sliding an "on/off" switch to the "on" position, or by other means, so as to remove the impediment from the actuating trigger's operating path.

Although utility lighters of the type described above provide some level of safety, there is much room for improvement. Specifically, in these lighters, once the locking means (e.g., the on/off switch) is disabled, the lighter remains in the unlocked state until the locking mechanism is activated again. Therefore, if the operator disables the locking mechanism in order to use the lighter, and then forgets to re-lock the lighter, the safety feature of the lighter is rendered useless, until the locking mechanism is again activated.

Other inventions have attempted to address the safety-related issues by impeding not the operation of the trigger, but that of the fuel-release mechanism. Of course, a utility lighter

containing such a mechanism would inhibit flame generation in the locked position as no fuel would be released until the locking mechanism has been deactivated. However, in these types of lighters, nothing prevents a spark from being generated. As such, the safety goals are only partially met in these types of lighters since young children handling the lighter could still create fires by operating the lighter in close proximity to a source of fuel or near carpets, paper, or other flammable material.

In order to address the above problems, some inventions have introduced locking mechanisms that are activated automatically after each use of the lighter. As such, in these lighters, two states of operation exist: the locked state and the operable state. In the locked state, neither a spark nor a flame can be generated. In contrast, in the operable state, the lighter is no longer locked, so that a flame can be generated. Although, in general, this improvement has alleviated some of the concerns mentioned above, there is still room for further improvement. Specifically, in most dual-state, automatic-locking lighters, once the lighter is unlocked and the trigger activated, the flame that is generated will subsist for as long as the trigger is held in the depressed position. In other words, once the locking mechanism is disabled, flame generation is a simple task involving depression of the trigger. This is of some concern since even young children might be able to achieve this task.

Therefore, there is a need for a device that not only achieves the stated safety goals in generating a flame, but also makes it difficult for inexperienced users and/or young children

to sustain the flame. The invention described herein offers such a combination. The invention requires that a safety button, protruding generally from the top portion of the lighter housing shell, be depressed simultaneously with a trigger before a flame can be produced. In addition, the invention requires that the safety button, and not necessarily the trigger, be held in its activated state in order for the flame to be sustained; releasing the safety button after simultaneous activation of both the safety button and the trigger will cause the flame to be extinguished.

The unique structure of the safety button and the cam mechanism contained in the present invention provides for an optimum amount of safety as it makes it very difficult, if not impossible, for young children to operate the device. Young children are capable of carrying out only simple mental concepts. As such, a young child wishing to operate the present invention would attempt do so in the usual way, i.e., by pressing the trigger. However, due to the automatic locking mechanism of the device, the trigger will not move. This alone will act as a deterrent as most young children will simply abandon the device after several unsuccessful attempts. This is true because a child operator must first recognize that both the trigger and the safety button must be operated simultaneously before a flame can be generated. Also, if the child does recognize that the slide-safety button plays a role in activating the lighter, then the child operator must also recognize that the safety button must be operated prior to the trigger to generate a flame. These concepts

are generally too convoluted a concept for young children to grasp or appreciate.

Nevertheless, even if a young child were to be able to learn the proper operation of the device, he or she would probably still be unable to actually operate the device. Given the relative location of the trigger and the safety button, operation of the present invention requires that the user be able to grasp the handle of the lighter in his or her hand, operate the trigger with the index finger, and simultaneously operate the safety button with the thumb. Also, this invention also requires the user be able to operate the slide-safety button with the thumb, and operate the trigger with the index finger. This, in turn, requires not only a significant amount of manual dexterity, but also hands that are sufficiently large, namely, adult hands. Moreover, successful operation of the device requires an amount of strength and pulp that are rarely found in the fingers of young children.

In addition, even if a child were to possess the mental capacity for understanding and learning the required process of operation, a large enough hand, and the required amount of manual dexterity, strength, and pulp, so that he or she could somehow generate a flame, he or she would have to recognize a second concept: that the flame will not be sustained unless the safety button is held in its activated state. Again, this is a difficult mental concept for a child to recognize and learn. Moreover, even if learned, the concept would be difficult for a child to operationalize given the above discussion regarding the mental and

physical limitations of young children. On the other hand, an adult user would have no difficulty operating the invention as the device requires no more than the simultaneous operation of two strategically positioned buttons.

In addition to all of the safety advantages described above, the invention described herein offers a significant reduction in cost, and a significant increase in ease, of manufacturing. The cam mechanism is an integrated, one-piece member that can perform the functions of two (2) or three (3) separate members in most other utility lighters currently available on the market. Moreover, the entire safety feature, as well as full operation of the device is generally enabled by the manufacture and use in the lighter of two (2) basic elements: the cam mechanism and the safety button. In addition, it is contemplated that these two elements may even be combined, so that only one integrated structural member need be produced. This, of course, would lead to even more significant savings and simplicity in the manufacturing process.

3. SUMMARY OF THE INVENTION:

The primary object of this invention is to provide a safety mechanism for utility lighters so that children or inexperienced users will be less likely to inadvertently activate the lighter. Such a safety feature is especially important because young children often play with lighters as toys and because lighters have mechanically moveable parts that make them attractive to children as toys.

Another object of the present invention is to prevent the generation of not only a flame, but even a spark. As noted previously, in a lighter where only the fuel-release mechanism is inhibited in the locked state, young children playing with the lighter can still use the lighter to create sparks. Depending on the child's surroundings, this can lead to the start of accidental fires if the child is operating the lighter near paper products or any other source of flammable material.

A further object of the invention described herein is to provide an improved device for maximizing safety in utility lighters without compromising ease of use. To this end, the addition of a safety button creates a simple additional step which, for the intended user, leaves the operation of the utility lighter as simple as it has always been to operate a regular utility lighter with no safety feature, yet, creates an additional mental step which acts as a deterrent for non-intended users.

Another object of this invention is to reduce the risk of unintended fires, especially by young children, by making it impossible for the flame to continue to burn unless two (2) separate functions are performed simultaneously and operation of a safety button is continued without interruption.

A final object of the present invention is to meet all of its safety goals while, at the same time, it maximizes ease of manufacturing and minimizes costs associated with manufacturing of parts.

The invention meets its objectives by providing a cam mechanism that integrates several structural elements. In a first

preferred embodiment, the cam mechanism consists of a cam lever, a fuel-release lever, and a return spring. Most significantly from a safety standpoint, the cam mechanism contains a cam lever that acts to lock the trigger in the inoperative position.

In a second preferred embodiment, the safety mechanism consists of a cam mechanism and a lever spring. The cam mechanism consists of a fuel-release lever and a safety button. The lever spring locks the trigger in the inoperative position.

Typically, a young child will attempt to activate the lighter by depressing the trigger only. However, when this is done, the trigger will not move at all or significantly, so that neither a spark nor a flame will be generated. Since the trigger is locked in this position, repeated operation of the trigger by a child will yield the same unsuccessful results.

The only way to activate the lighter is to depress the safety button. In the first preferred embodiment, depressing the safety button moves the cam lever out of the path of the trigger, so that the trigger can now be depressed. In the second preferred embodiment, depressing the safety button moves the lever spring out of the path of the trigger, so that the trigger can now be depressed.

Depression of the safety button also causes the fuel-release lever to move, so that, depending on the extent of pressure placed on the safety button, the fuel-release valve may be opened and fuel released. As such, a second significant safety-related feature of the present invention is that a small amount of pressure on the safety button will release the trigger lock.

However, such pressure will not release sufficient fuel for a flame to be produced. That is, the most that can happen when the user presses the safety button slightly, and then depresses the trigger, is that a spark would be generated. To ignite the spark, the user would have to continue pressing the safety button further than is required to release the lock, so that sufficient fuel is released before the trigger is activated and a spark and flame are generated.

The above procedure ensures that even if a child were to be able to momentarily press the safety button to release the lock, he or she would still have trouble creating a flame, as doing so would require further pressure on the safety button. This is a simple, yet effective concept. Nevertheless, it is a concept that a young child operating the lighter must recognize and grasp before he or she can successfully operate the lighter. In most cases, the child either will not recognize the usefulness of the safety button or, if he/she does, he/she will not be able to simultaneously press the safety button far enough to create a flame. As such, the child will most likely abandon the lighter after several unsuccessful attempts.

Once the intended operator has pressed the safety button far enough to both unlock the trigger and provide adequate fuel release, the operator then presses the trigger in order to generate a flame. However, to sustain the flame, the operator must continue to hold the safety button in its activated position. This is a significant departure from lighters that are currently in the market. In most lighters currently in use, once a flame is

generated by depressing a trigger, the flame will subsist for as long as the operator continues to hold the trigger in its activated position. In contrast, in the present invention, the cam mechanism allows separation of fuel-release on the one hand, and spark generation on the other, so that spark generation will not necessarily lead to the production of a sustained flame.

It follows that, to successfully operate the present invention, the user must recognize that, once a flame has been generated, it is the safety button, and not the ignition trigger, that must be held in the activated position. This is another procedural step which creates a mental concept that is simple for the adult user to grasp and practice, but difficult for young children to either grasp or practice.

In the first preferred embodiment, once the user no longer needs the flame and the safety button is released, the return spring in the cam mechanism ensures that the cam lever, the fuel-release lever, and the safety button return to their original stationary positions, thus also automatically re-locking the trigger in the inoperable state. In the second preferred embodiment, the lever spring ensures that the fuel-release lever and the safety button all return to their original stationary positions when the safety button is released, thus also automatically re-locking the trigger in the inoperable state.

As can be understood from the above description, the invention disclosed herein achieves its safety objectives without making operation of the lighter any more cumbersome than a regular utility lighter. Specifically, the safety button is positioned in

such a way that operation of the lighter is very simple in experienced hands. An adult user familiar with the operation of utility lighters still needs to use only one finger to sustain the flame. This allows the user to operate the lighter in a safe, yet non-complicated manner.

This and other advantages of the present invention will become more apparent through the following description of the drawings and detailed description of the preferred embodiment.

4. BRIEF DESCRIPTION OF THE DRAWINGS:

Fig. 1 is a sectional view showing an embodiment of a child-resistant utility lighter according to the first preferred embodiment; and

Fig. 2 is a sectional view showing an embodiment of a child-resistant utility lighter according to the second preferred embodiment.

Fig. 3 is a perspective view of the child-resistant utility lighter;

Fig. 4 is an environmental view of the child-resistant utility lighter in use;

Fig. 5 is a sectional view of the third embodiment of the lighter without the trigger, the safety button, the locking spring, or the stopper tab;

Fig. 6 is a sectional view of the third embodiment of the lighter;

Fig. 7 is a sectional view of the third embodiment with the trigger being depressed in the direction of the arrow while the trigger is in the locked position;

Fig. 8 is a sectional view of the third embodiment with the safety button being translated in the direction of the arrow and the trigger being depressed in the direction of the arrow;

Fig. 9 is a like view with the trigger fully depressed;

Fig. 10 is a perspective view of the right side of the safety button;

Fig. 11 is a perspective view of the left side of the safety button;

Fig. 12 is a perspective view of the trigger of the third embodiment;

Fig. 13 is a sectional view of the fourth embodiment;

Fig. 14 is a sectional view of the fifth embodiment of the lighter without the trigger, the safety button, the leaf spring, or the stopper tab;

Fig. 15 is a sectional view of the fifth embodiment of the lighter;

Fig. 16 is a sectional view of the fifth embodiment with the trigger being depressed in the direction of the arrow while the trigger is in the locked position;

Fig. 17 is a sectional view of the fifth embodiment with the safety button being translated in the direction of the arrow and the trigger being depressed in the direction of the arrow; and

Fig. 18 is a perspective view of the trigger and the locking lever of the fifth embodiment.

5. DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

A general description of the piezoelectric utility lighter (1) will be provided before presenting a detailed description of the improvement in the safety feature that constitutes the invention.

Generally, the elements of the utility lighter (1) include a lighter housing (10), a lighting rod attached to the forward end of the lighter housing via engagement means such as a support ring which slides over the overlapping portions of the lighter housing and lighting rod, a fuel tank (30)(Fig. 5), a piezoelectric unit (40), and a trigger (100).

The lighter housing (10) is comprised of two shells, cut along the longitudinal axis of the lighter (1). Figs. 1, 2, and 5 show one of these shells. The lighter housing (10) has a back end (10a) and a forward end (10b)(Fig. 5), where the forward end is equipped with engagement means such as a support ring (Fig. 5) to engage the lighting rod. The lighting rod, which typically has a cylindrical cross section, has a free end which constitutes the tip of the lighter (1) and an engagement end which connects to the forward end of the lighter housing. Where the forward end of the lighter housing and the engagement end of the lighting rod overlap, there is provided a support ring (Figs. 4, 5) which slides over and maintains the lighter housing-lighting rod combination.

The lighter (1) is equipped with a fuel tank (30) near the back end (10a) of the lighter housing (10). The fuel tank (30) has a bottom portion (30a) facing the back end (10a) of the lighter housing, and a top portion (30b) pointing towards the forward end of the lighter housing. A fuel-release valve (31) is attached to the top portion (30b) of the fuel tank. This valve is spring loaded so that it is normally urged to the closed position. The valve is also provided with a gas tube (32) which extends through the lighting rod and to a discharge nozzle at the free end of the lighting rod. The valve is opened via the operation of a fuel-release lever (70) from the translation of the safety button or release lever. Finally, a flame-adjusting knob (33) is provided on the valve (31) which can be turned to adjust the amount of fuel released and, thus, the height of the resultant flame.

The next element of the lighter (1) is a piezoelectric or fuel ignition unit (40). This unit is fitted within the top portion (30b) of the fuel tank and protrudes from said top portion. The upper section of the piezoelectric unit (40) constitutes the sliding section (41). The sliding section (41) has a contact surface (42) that is in contact with an undersurface (102) of trigger (100). Operation of the piezoelectric unit (40) creates an electric discharge that is carried to the free end of the lighting rod via a wire.

One of the primary elements of the first preferred embodiment (Fig. 1) is a cam mechanism (60). The cam mechanism has a hub (61), as well as three projections that extend in generally

different directions. These projections are: a fuel release lever (70), a cam lever or latch (80), and a return spring (90).

The hub (61) is held in place by a cam-support pin (50). The cam-support pin is a projection that extends from the inner surface of one of the lighter housing shells (10) in a direction that is perpendicular to the longitudinal axis of the lighter (1). The hub fits onto and is supported by the cam-support pin.

The fuel-release lever (70) has one end (71) that is located between the valve (31) and the flame-adjusting knob (33), and an opposing end that is integral with the hub (61) of the cam mechanism (60).

The cam lever or latch (80) has one end that is integral with the hub (61) of the cam mechanism (60) and an opposing free end that constitutes the cam-lever edge (81). The cam lever also has an upper surface (82), a lower surface (83), and a cavity (84). The cavity (84) houses a safety-button pin (123) of a safety button (120).

The return spring (90) also has one end that is integral with the hub (61) of the cam mechanism (60) and an opposing free end (91). The return spring further consists of an upper surface (92) and a lower surface (93), where the lower surface rests on a projection (15) that is fixedly attached to the inner surface of one of the lighter housing shells (10).

The next primary element of the first preferred embodiment is the trigger (100). The trigger is slidably mounted between the two shells of the lighter housing (10). As in conventional utility lighters, the trigger is allowed to slide back and forth

along the longitudinal axis of the lighter (1). The trigger has an operation section (101) that protrudes from the lighter housing (10) so as to be operated by a finger of the user. Generally, the operation section (101) has a surface that is slightly curved so as to appear concave. However, the invention described herein is amenable to different degrees of curvature for the operation section (101) of the trigger.

The trigger (100) also has an undersurface (102) that makes contact with the contact surface (42) of the sliding section (41) of the piezoelectric unit (40). In addition, the trigger (100) is integral with a trigger tab (103) and a stopper tab (110). The trigger tab (103) is a projection that makes contact with the upper surface (82) of the cam lever (80). The stopper tab (110) is typically placed underneath the trigger tab (103) and has a contact edge (111) that engages the cam lever edge (81).

The next primary element of the first preferred embodiment is a safety button or release lever (120). The safety button (120) is slidably fitted within the top surface of the lighter housing shell and has an operation section or external end (121) that protrudes from this top surface of the lighter housing. The safety button has a lower surface (122) that is integral with a safety-button pin (123), which pin (123) is in contact with the cam lever (80) via the cavity (84) in said cam lever. The safety button (120) is also integral with a set of flanges (124) that can make contact with the inner portion of the top surface of the lighter housing shell, thus limiting the range of motion of the safety button (120).

In the first preferred embodiment (Fig. 1), the primary elements of the safety-related invention described herein, as well as the interaction between these and the other, more conventional, elements of the utility lighter can be further defined as follows.

In the first preferred embodiment, the hub (61) of the cam mechanism (60) is fitted onto and supported by the cam-support pin (50), so that the hub (61) is capable of rotating around the cam-support pin (50). In order to operate the lighter (1), the user must press the trigger (100) to create a spark, and release fuel so that a flame can be generated. However, when the user attempts to press the trigger (100), the trigger will not move significantly or at all.

In the inoperable state (non-operational lighting position), the trigger tab (103) is in contact with the upper surface (82) of the cam lever (80). The trigger (100) is integral with a stopper tab (110) whose contact edge (111) engages the cam-lever edge (81) of the cam lever (80). This acts as a locking mechanism which must be released before the trigger can be moved. To release the lock, the user must press the safety button (120) by pushing on or manipulating the safety button operation section (121). When the safety button (120) is depressed, the motion of the safety button (120) is translated to the cam lever (80) via the safety-button pin (83) as resistance is provided by the return spring (90) pressing against the projection (15).

Initially, the cam lever or latch (80) moves, so that its cam-lever edge (81) is disengaged from the contact edge (111) of the stopper tab (110)(operational position). In addition, the

initial pressing of the safety button (120) will cause the fuel-release lever (70) to also move slightly. However, this movement will be insufficient to release an amount of fuel that is adequate for flame production.

With the locking mechanism disengaged, the user can now press the trigger (100) in order to create a spark. As the operation section (101) of the trigger (100) is pushed, the undersurface (102) of the trigger (100) contacts the contact surface (42) of the sliding section (41) of the piezoelectric unit (40). In this way, as the trigger (100) is activated, so is the piezoelectric unit (40), so that a spark is generated when the sliding section (41) has moved back far enough.

Without more, the operational procedure described above will only produce a spark. In order to produce a flame, the operator must continue to push the safety button or release lever (120), thereby further moving the cam lever (80). This, in turn, causes further rotation of the hub (61), which causes the fuel-release lever (70) to open the fuel-release valve (31) and release fuel. Now, with the safety button (120) held in this position, depression of the trigger (100) will allow a flame to be generated.

Once a flame has been generated, it can be sustained only if fuel continues to be supplied. As explained above, this will only occur if the safety button (120) is held in position and not released after a flame has been generated. Simply holding the trigger (100) in the activated state will not sustain the flame. That is, even though, after the lighter has been unlocked,

depression of the trigger (100) might cause the upper surface (82) of the cam lever (80) to be held underneath the bottom surface of the stopper tab (110), the hub (61) of the cam mechanism (60) has not rotated enough at this point for the fuel-release lever (70) to be able to move and sufficiently open the fuel-release valve (31).

Once the flame is no longer needed, the safety button (120) is released. This allows both the cam lever (80) and the fuel-release lever (70) to return to their stationary positions under the urging influence of return spring (90). Once in this position, the cam-lever edge (81) again engages the contact edge (111) of the stopper tab (110), thereby automatically re-locking the lighter. Finally, as the safety button (120) moves to its stationary position, it is stopped in that position when flanges (124) reach the inner portion of the top surface of the lighter housing shell.

In the second preferred embodiment (Fig. 2), one of the primary elements of the lighter is the cam mechanism (60). The cam mechanism (60) has a hub (61) and two projections: a fuel-release lever (70) and a safety button (120).

The cam mechanism (60) is held in place by a cam-support pin (50). The cam-support pin is a projection that extends from the inner surface of one of the lighter housing shells (10) in a direction that is perpendicular to the longitudinal axis of the lighter (1). The hub (61) of the cam mechanism (60) fits onto and is supported by the cam-support pin.

The fuel-release lever (70) has one end (71) that is located between the valve (31) and the flame-adjusting knob (33), and an opposing end that is integral with the hub (61) of the cam mechanism (60).

The safety button (120) is slidably fitted within the top surface of the lighter housing shell (10) and has an operation section (121) that protrudes from this top surface. The safety button has a safety button projection (151) that contacts the lever spring (150). The safety button has a lower portion (122) that is integral with the hub (61). A safety button stop (152) limits the downward range of motion of the safety button. The safety button stop is a projection that extends from the inner surface of one of the shells in a direction that is perpendicular to the longitudinal axis of the lighter (1).

The next primary element of the second preferred embodiment is the lever spring (150). The lever spring has one end that constitutes a lever spring edge (112) and an opposing end that is fixed to a spring projection (15) that is fixedly attached to the inner surface of one of the lighter housing shells.

The next primary element of the second preferred embodiment is the trigger (100). The trigger is slidably mounted between the two shells of the lighter housing (10). As in conventional utility lighters, the trigger is allowed to slide back and forth along the longitudinal axis of the lighter (1). The trigger has an operation section (101) that protrudes from the lighter housing so as to be operated by a finger of the user. Generally, the operation section has a surface that is slightly curved so as to

appear concave. However, the invention described herein is amenable to different degrees of curvature for the operation section of the trigger.

The trigger (100) also has an undersurface (102) that makes contact with the contact surface (42) of the sliding section (41) of the piezoelectric unit (40). In addition, the trigger is integral with a trigger tab (103) and a stopper tab (110). The trigger tab is a projection that makes contact with the upper surface of the lever spring (150). The stopper tab is typically placed underneath the trigger tab and has a contact edge (111) that engages a lever spring edge (112).

In the second preferred embodiment (Fig. 2), the primary elements of the safety-related invention described herein, as well as the interaction between these and the other, more conventional, elements of the lighter can be further defined as follows:

In the second preferred embodiment, the hub (61) of the cam mechanism (60) is fitted onto and supported by the cam-support pin (50), so that the hub is capable of rotating around the cam-support pin (50). In order to operate the lighter (1), the user must press the trigger (100) to create a spark, and release fuel so that a flame can be generated. However, when the user attempts to press the trigger, the trigger will not move significantly or at all.

When the lighter is in the locked position, the trigger tab (103) is in contact with the upper surface of the lever spring (150), and the contact edge (111) of the stopper tab (110) engages the lever spring edge (112). Engagement of these edges acts as a

locking mechanism which must be released before the trigger can be moved. To release the lock, the user must depress the safety button or release lever (120) by depressing the safety button operation section or external end (121) of the safety button. When the safety button is depressed, the motion of the safety button is translated to the lever spring via the safety-button projection (152) as resistance is simultaneously provided by the flexing of the lever spring (150).

Initially, the lever spring (150) moves, so that its lever spring edge (112) is disengaged from the contact edge (111) of the stopper tab (110). In addition, the initial depression of the safety button (120) will cause the fuel-release lever (70) to also move slightly. However, this movement will be insufficient to release an amount of fuel that is adequate for flame production.

With the locking mechanism disengaged, the user can now press the trigger (100) in order to create a spark. As the operation section (101) of the trigger is pushed, the undersurface (102) contacts the contact surface (42) of the piezoelectric unit (40). In this way, as the trigger is activated, so is the piezoelectric unit, so that a spark is generated when the sliding section (41) has moved back far enough.

Without more, the operational procedure described above will only produce a spark. In order to produce a flame, the operator must continue to push the safety button (120), thereby causing further rotation of the hub (61), which causes the fuel-release lever (70) to open the fuel-release valve (31) and release fuel. The safety button stop (152) limits the distance the safety button

can be depressed. Now, with the safety button (120) held in this position, depression of the trigger (100) will allow a flame to be generated.

Once a flame has been generated, it can be sustained only if fuel continues to be supplied. As explained above, this will only occur if the safety button (120) is held in the depressed position and not released after a flame has been generated. Holding the trigger (100) in the activated state alone will not sustain the flame.

Once the flame is no longer needed, the safety button (120) is released. This allows the fuel-release lever (70) to return to its stationary position under the urging influence of the lever spring (150). Once in this position, the lever spring edge (112) again engages the contact edge (111) of the stopper tab (110), thereby automatically re-locking the lighter.

In the third embodiment of the invention, the next element of the lighter (1) is a piezoelectric unit (40) (Fig. 6). This unit is fitted within the top portion (30b) of the fuel tank and protrudes from said top portion. The upper section of the piezoelectric unit (40) constitutes the sliding section (41). The sliding section (41) contacts the trigger (100). Actuation of the piezoelectric unit or fuel ignition unit (40) creates an electric discharge that is carried to the free end of the lighting rod via a wire (242).

The present invention includes a trigger (100), a locking mechanism, and a safety button (270).

The trigger (100) is slidably mounted between the two shells of the lighter housing (10). As in conventional utility lighters, the trigger (100) is allowed to slide back and forth along the longitudinal axis of the lighter (1). The trigger (100) has an operation section (101) that protrudes from the lighter housing (10) so as to be operated by a finger of the user.

Generally, the operation section (101) has a surface that is slightly curved so as to appear concave. However, the invention described herein is amenable to different degrees of curvature for the operation section (101) of the trigger (100). The trigger (100) contacts the sliding section (41) of the piezoelectric unit (40). Full depression of the trigger results in actuation of the piezoelectric unit.

The locking mechanism prevents the trigger from being depressed until the safety button or release lever (270) has been translated into the active position. The safety button, when in the active position, opens the valve (31) to release fuel.

The safety button (270) is slidably mounted in the lighter housing (10). The safety button includes a contact surface (274) (Figs. 10 and 11), a return spring (275), a fuel-releasing segment (276), and a unlocking segment(277). The contact surface protrudes beyond the lighter housing for receiving the user's finger. The safety button is translated from its initial position to its active position when the user pushes the safety button forward in the direction of the arrow A (Figs. 8 and 9). The return spring constantly urges the safety button into its initial position.

The fuel-releasing segment (276) of the safety button (270) is located between the valve (31) and the flame-adjusting knob (33). The unlocking segment (277) of the safety button is located above the trigger (100). When the safety button is translated by being pushed forward, the fuel-releasing segment opens the valve, and fuel is released.

The third preferred embodiment of the invention includes a trigger (100) (Fig. 6), a stopper tab (273), a safety button (270), and a locking spring (272). The trigger (Fig. 12) includes an operation section (101), a locking lever (271), a projection (278), and a locking spring (272). The stopper tab is formed in the top portion of the fuel tank (30). The locking spring is mounted to the lighter housing (10) and is constantly urging the trigger into the locked position.

Depression of the trigger (100) alone (Fig. 7) without also activating the safety button (270), results in the locking lever (271) engaging the stopper tab (273). Thus preventing actuation of the piezoelectric unit (40).

Activation of the safety button (270) causes the unlocking segment (277) (Fig. 8) to interact with the projection (278). This interaction between the unlocking segment and the projection forces the locking lever (271) downward thus disengaging it from the stopper tab (273). The projection must be sufficiently large to move the locking lever a sufficient distance such that it cannot engage the stopper tab. As a result, the trigger (100) can be fully depressed thus actuating the piezoelectric unit (40).

Once a flame has been generated, it can be sustained only if fuel continues to be supplied. Simply holding the trigger (100) in the depressed state will not sustain the flame. Fuel continues to be supplied only as long as the safety button (270) is held in the active position.

When the safety button or release lever (270) is released the return spring (275) urges the safety button into its initial position. As a result, the locking lever (271) returns to the locked position and the valve (31) returns to the closed position. Once in the locked position, the locking lever (271) re-engages the stopper tab (273). Therefore, the lighter (1) is thereby automatically re-locked.

The fourth preferred embodiment of the invention includes a trigger (100) (Fig. 13), a safety button (270), a locking lever (271), and a locking spring (272).

The locking lever (271) has a first end (281) and a second end (291). The second end of the locking lever is pivotally mounted to the lighter housing (10). The trigger (100) includes a stopper tab (273). The stopper tab (273) engages the first end of the locking lever (271). The stopper tab blocks the first end of the locking lever, and as a result, the trigger cannot be squeezed to actuate the lighter. The locking spring (272) urges the locking lever into the locked position.

The unlocking segment (277) of the safety button (270) includes a ramped portion (283). When the safety button is activated, the ramped portion contacts the locking lever (271) and depresses the locking lever. When the locking lever is depressed,

the locking lever is disengaged from the stopper tab (273). Thus activating the safety button unlocks the trigger (100), and the trigger can then be depressed and the piezoelectric unit (40) actuated.

Once a flame has been generated, it can be sustained only if fuel continues to be supplied. Simply holding the trigger (100) in the depressed state will not sustain the flame. Fuel continues to be supplied only as long as the safety button (270) is held in the active position.

When the safety button (270) is released, the return spring (275) urges the safety button into the initial position. Once the safety button is in its initial position, the locking lever (271) returns to the locked position under the force of the locking spring (272) and the valve (31) returns to the closed position. When the locking lever returns to the locked position, the locking lever (271) again engages the stopper tab (273). The lighter (1) is thereby automatically re-locked.

The fifth embodiment of the invention (Figs. 14-18) includes a trigger (100), a stopper tab (273), a safety button (270), a locking lever (271), and an arm locking spring or arm spring (284).

The locking lever (271) has a first end (340), a second end (341), and a projection (278). The second end of the locking lever is pivotally mounted to a pivot point projection (342) extending from the lighter housing (10). The trigger (100) includes the stopper tab (273). The stopper tab engages the first end of the locking lever. The stopper tab blocks the first end of

the locking lever, and as a result, the trigger cannot be squeezed to activate the lighter (1).

The arm spring (284) has an arm (285) and a coiled end (286). The coiled end of the arm spring is coiled and sized to be securely mounted to the pivot point projection (342). The arm extends radially outward from the coiled end of the arm spring and is biased against the bottom surface of the locking lever (271). The arm spring urges the locking lever into the locked position.

The unlocking segment (277) of the safety button (270) includes a ramped portion (283). When the safety button is activated, the ramped portion contacts the projection (278) of the locking lever (271) and depresses the locking lever. The projection must be sufficiently large to move the locking lever a sufficient distance such that it cannot engage the stopper tab (273). When the locking lever is depressed, the locking lever is disengaged from the stopper tab (273). Thus, activating the safety button unlocks the trigger (100), and the trigger can then be depressed and the piezoelectric unit (40) actuated.

Once a flame has been generated, it can be sustained only if fuel continues to be supplied. Simply holding the trigger (100) in the depressed state will not sustain the flame. Fuel continues to be supplied only as long as the safety button or release lever (270) is held in the active position.

When the safety button (270) is released, the return spring (275) urges the safety button into the initial position. Once the safety button is in its initial position, the locking lever (271) returns to the locked position under the force of the arm spring

(284), and the valve (31) returns to the closed position. When the locking lever returns to the locked position, the locking lever again engages the stopper tab (273). The lighter (1) is thereby automatically re-locked.